New England's Ecosystems

"Eventually, all things merge into one, and a river runs through it."
—Norman Maclean

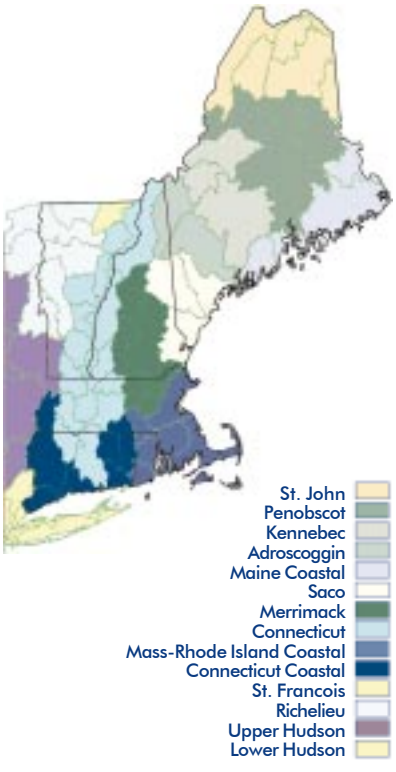
New England is blessed with clear mountain streams, fertile river valleys, numerous lakes and ponds, vital urban rivers, and coastal estuaries teeming with life. The terrestrial areas—mountains, woodlands, meadows, and marshes—that surround these waters form a network of habitats that make up our region's watersheds. Clean water, productive land, and healthy habitats depend on the quality of the sixty-five watersheds within the 14 major river basins in our region (**Figure 15**).

The Watershed Idea

A watershed is a geographic area consisting of all the land that drains to a particular body of water. Watersheds vary in size, shape, and complexity. All terrestrial animals—including human beings—live in a watershed and have a direct impact on the quality and quantity of water and other natural resources in that watershed. Watershed management is based on understanding each watershed as a single hydrologic and ecological system, and involving the people who live and work there in decisions about its use and management.

No single agency or group, however, can be responsible for this extensive task. There are over 350 active watershed groups, including various state, local, and regional partnerships, working on watershed issues in New England. EPA-New England was a major participant in coordinating the Northeast Watershed Roundtable, designed to encourage dialogue and build new relationships between government and other organizations and to develop creative ways to address water quality, instream flow, riparian buffers, watershed planning, habitat restoration, growth management, and wetlands protection. Along with a great deal of excitement and enthusiasm, the Watershed Roundtable is generating the Northeast Watershed Strategy—an action plan and set of recommendations for protecting and restoring New England's watersheds.

Figure 15
Major River Basins in New England



source: EPA-New England

Watershed Resource Guide

The Watershed Resource Guide is a directory that lists current documents published by EPA on watershed management for the public to read and use. The guide covers six categories: watershed planning and management, drinking water, non-point source pollution, watershed education, volunteer monitoring, and habitat. Copies of the guide and the documents it describes are available at no cost to anyone with an interest in protecting our surface water and groundwater supplies by calling 1-888-372-7341. We hope that the publications in this guide will be requested and used throughout New England by watershed associations, town officials, conservation commissions, students, and anyone else interested in understanding the watershed approach.

Aquatic Life & Fish Consumption in New England Waters

States, federal agencies and local organizations are making co-ordinated efforts to assess the conditions of our waters. Nutrients, bacteria, metals, organic chemicals and destruction of shoreline and natural habitats are generally at the top of the list of causes of impairment to New England waters. Although we are reducing point sources of pollution, non-point sources continue to present a challenge to local, state and federal agencies. We need more pollution prevention and innovative approaches and technology to reduce non-point source stresses.

Statewide fish advisories to limit consumption due to mercury continue in all states except Rhode Island and remain a national concern.

Impaired New England Waters

Designated Use (Measure of Impairment)	River/Stream Miles	Lake/Pond Acres	Estuarine Sq. Miles
Fish Consumption (Advisories)	83%	90%	1%
Swimming (Beach Closures)	6%	16%	3%
Aquatic Life (Unhealthy Organisms, Poor Habitat)	7%	20%	9%

source: State 305(b) Reports

EPA-New England is actively participating in the Clean Water Action Plan announced by Vice President Gore in 1997 on the 25th anniversary of the Clean Water Act. The plan is designed to build on the success we've had in cleaning the nation's waters over the previous years, and to more aggressively clean up remaining problems. The Plan's three major goals are to enhance protection from the threats to public health that are posed by water pollution, to more effectively control polluted runoff, and to promote water quality on a watershed basis. In New England, we will be working together with other federal agencies, Indian tribes, the states, communities, and their citizens to tackle outstanding water quality issues, emphasizing innovative approaches to pollution control wherever possible.

Nutrients: Too Much of a Good Thing

As part of its Clean Water Action Plan, EPA is initiating a new national nutrient criteria program to develop region-specific nutrient target ranges for phosphorus and nitrogen. Excessive phosphorous is the primary cause of eutrophication in freshwater lakes, streams, and rivers, while in coastal and marine systems, nitrogen is the main contributor. Symptoms include extensive algal blooms, low levels of dissolved oxygen (resulting in fish kills), high turbidity, and loss of submerged aquatic vegetation. Nutrients reach New England's waters from sewage treatment plants, stormwater runoff from developed areas, leachate from septic systems, agricultural runoff, and in the case of nitrogen, atmospheric deposition. Many streams and rivers in New England have been altered by construction of flood control or hydroelectric dams, exacerbating the effects of nutrient enrichment and resulting in eutrophication.

A study conducted by the U.S. Geological Survey (USGS) in streams in Connecticut from 1980 to 1992 found decreases in ammonia and phosphorous levels although the total nitrogen concentrations were unchanged. These changes came after more effective wastewater treatment was installed and significant improvements in water quality resulted.

From 1992 to 1995, the USGS as part of its National Water Quality Analysis (NAWQA) program sampled 61 stations for nutrient concentrations in Connecticut, Massachusetts, Vermont and New Hampshire. In general, nutrient concentrations for both nitrogen and phosphorus were higher in streams draining predominantly urban areas, than in streams draining agricultural or forested areas. The median concentration of total phosphorus in urban streams exceeded the commonly used benchmark of 0.1 mg/l, indicating the potential for eutrophic conditions. More information on NAWQA can be found on the following website (http://wwwrvares.er.usgs.gov/nawqa/nawqa_home.html)

web

Free Flowing Waters

Restoring the ecological integrity of our rivers is a major objective of the Clean Water Act. A critical step in acheiving this goal is removal of obstructions to migrating anadromous fish such as Atlantic salmon, shad, and alewives, which live as adults in saltwater, but migrate up rivers and streams to spawn. EPA-New England has been involved in river

restoration throughout the region. It participated in a multi-agency team that helped the Federal Energy Regulatory Comission (FERC) in its decision to deny relicensing and order the removal of Edwards Dam on Maine's Kennebunk River; this will allow striped bass, rainbow smelt, and the endangered shortnose sturgeon to access their historic ranges on the river. EPA also supported the Coastal America Initiative to remove three dams on tributaries to the Penobscot River, and was a key participant in the settlement process for the relicensing of the Fifteen Mile Falls Project on the Upper Connecticut that will generate funds for river restoration and dam removal.

In addition to hydroelectric dams, a growing problem threatening improvements to river and stream water quality is the ever-increasing withdrawal and diversion of water for snowmaking, industrial and commercial use, agriculture, and municipal water supply. Besides habitat loss, the loss of the seasonal respite afforded by natural flow fluctuations can weaken native species, deplete their food supplies and make them more susceptible to disease. EPA-New England is working with the six New England states and the New England Interstate Water Pollution Control Commission to develop a set of standards to deal with flow restoration and to ensure that anti-degradation regulations and policies adequately address activities that have an impact on water quality.

The Massachusetts Watershed Initiative

For the past two years, EPA-New England has been an active participant in the Massachusetts Watershed Initiative, a multi-agency partnership including state and federal representatives, watershed councils, and community partners. It was organized to develop plans and target agency resources toward protecting aquatic ecosystems and restoring water quality to fishable and swimmable status throughout the state's watersheds. EPA participation involves assistance for citizen volunteer monitoring efforts, conducting water quality and sediment toxicity sampling, Geographic Information System (GIS) support in developing watershed maps and data layers, and training volunteers to collect data on point and non-point sources of pollution.

Our American Heritage Rivers — The Connecticut and the Blackstone/Woonasquatucket

The American Heritage Rivers Initiative is designed to help communities revitalize their rivers—and the streets, historic buildings, natural habitats, and parks along their shores—in celebration of river history and heritage. The goal of the program is to coordinate the existing programs and funding of the federal government to improve the delivery of services to rivers and river communities. EPA and other federal agencies work cooperatively with state agencies and local individuals and organizations to restore and enhance the river services that are valued by both humans and wildlife. New England is proud to be home to two of the fourteen nationally designated American Heritage Rivers, the Connecticut River and the Blackstone/Woonasquatucket Rivers. For general information on the American Heritage River Initiative, visit EPA's Rivers website (http://www.epa.gov/rivers). web

Photo: Roy Crystal

Pollutant Trading: Sudbury River

When Congress Group Ventures wanted to redevelop an old Raytheon site in Wayland, Massachusetts, they faced a problem: the development would require a small water treatment plant, but because the Sudbury River was already overpolluted with phosphorous, by law they could not be granted a permit for the plant.

EPA-New England came up with an innovative permit for the development. Under the terms of the permit, the developer can go ahead with the development, but for every pound of phosphorous discharged from the development, they must eliminate three pounds from elsewhere in the watershed. This will be easily accomplished by connecting some of the many leaky septic systems in the area to the development's treatment plant. This innovative permit allows the development to go forward, increasing the town's tax rolls and allowing the reuse of an old site instead of developing open space elsewhere. At the same time, the development will actually leave the river cleaner than before. EPA-New England is looking forward to applying this approach elsewhere in the region.

Disappearing Shiners

Historically, the bridle shiner (*Notropis bifrenatus*), was one of the most common minnows in Massachusetts ponds, but the species is intolerant of nutrient over-enrichment from failing septic systems; runoff from golf courses, roads, lawns, and other shoreline development; water level manipulation; and introduction of non-native plants and fish. Recent surveys by the New England Aquarium of sixty-nine sites in eastern Massachusetts failed to find bridle shiners in 75% of the ponds where they were formerly found. EPA's EMAP (Environmental Monitoring Assessment Program) recently found bridle shiners in only two of twenty-five lakes surveyed in the state, suggesting an even greater decline. Massachusetts has designated it a Species of Special Concern. EPA-New England is helping to develop the tools needed to manage wastewater flow and promote less dense pondside development and natural vegetation buffer zones around undeveloped ponds to maintain healthy shiner habitat and pond ecosystems for the future.

Photo: Amelia Katzen

The Connecticut River is New England's longest river, stretching approximately 410 miles from the Canadian border through New Hampshire, Vermont, Massachusetts and Connecticut to Long Island Sound. Communities along the river identified sixteen different projects, including agricultural preservation and natural resource protection; habitat restoration, riverbank stabilization, and water quality protection; and urban riverfront revitalization as part of its bid for heritage designation. The Upper Connecticut River Project is a local, federal, and state partnership focused on reducing bank erosion, water contamination, identifying and cleaning toxic hot spots, restoring natural streamflow characteristics, making the river swimmable in all places, reducing the impact of invasive species, and improving the resident and anadromous fisheries and fishing opportunities. EPA-New England has helped fund a study to analyze the river's flow regimes and the impact of these regimes on its physical and biological functions, and provided technical assistance in establishing a website (http://www.crjc.org) for the Connecticut River Joint Commissions.

The Blackstone and Woonasquatucket Rivers flow into Providence Harbor, meeting to form the head of Narragansett Bay. The rivers represent an extraordinary range of environmental conditions—from pristine rural landscapes to densely populated inner-city neighborhoods of Worcester and Providence. More than a century of industrial manufacturing has left toxins embedded in river sediments and degraded wildlife habitat along the shore. American Heritage River designation is helping to reclaim the rivers as community assets by improving water quality, preserving historical and natural resources, and rejuvenating neighborhoods along the riverfront through federal, state, and community efforts.

Watershed Stories:

The Hoosic River

The Hoosic River watershed covers 720 square miles. The river's tributaries begin in the Green Mountains of Vermont, the Taconics of New York, and the slopes of Mount Greylock, the tallest mountain in Massachusetts. As a member of the Hoosic River Watershed Team, EPA-New England has provided technical help to the Hoosic River Watershed Association and the Massachusetts Department of Environmental Protection in conducting water quality sampling and analysis for PCBs, heavy metals, and other toxic substances, developing watershed maps, and facilitating an inter-agency Watershed Ecosystem Partnership to promote ecosystem preservation and restoration of the Hoosic River Watershed.

The Salmon Falls-Piscataqua River

EPA-New England has initiated a targeted approach to improve water quality in the Salmon Falls/Piscataqua River that forms a portion of the border between Maine and New Hampshire. EPA funding enabled the New England Interstate Water Pollution Control Commission to perform an economic analysis of various treatment alternatives for the municipalities discharging wastewater to the river. As the pressure for more development increases, however, the biggest challenges for protecting water quality will

be from diverse non-point sources of pollution. The river has already exceeded the amount of phosphorus it can tolerate. EPA-New England, the states, and other federal partners such as the Natural Resources Conservation Service (NRCS), will work with communities to control pollution from non-point sources and minimize future costs of wastewater treatment.

The Pawcatuck Watershed

The Pawcatuck watershed has been targeted as one of EPA-New England's Special Places, with several centuries of historical resources in a remarkably rural and unspoiled natural setting. It is rich in Native American sites, family-owned farms, small-scale industrial villages, summer colonies, and a vital, picturesque downtown area. The watershed supports a high diversity of species, including neotropical migrant birds, freshwater mussels, river invertebrates, reptiles, and amphibians. Covering about one fifth of Rhode Island, it nevertheless contains about 70% of Rhode Island's rare species and natural communities. The future of the Pawcatuck watershed, however, is not secure. Human population growth is leading to accelerated non-point source pollution and to habitat fragmentation. Control over many of the existing and potential threats to the environment will increasingly depend on those who live and work there. EPA-New England is participating in the Pawcatuck Watershed Partnership, a new effort to protect this watershed, promote sustainable economic vitality, and maintain healthy communities in this unique and special place.

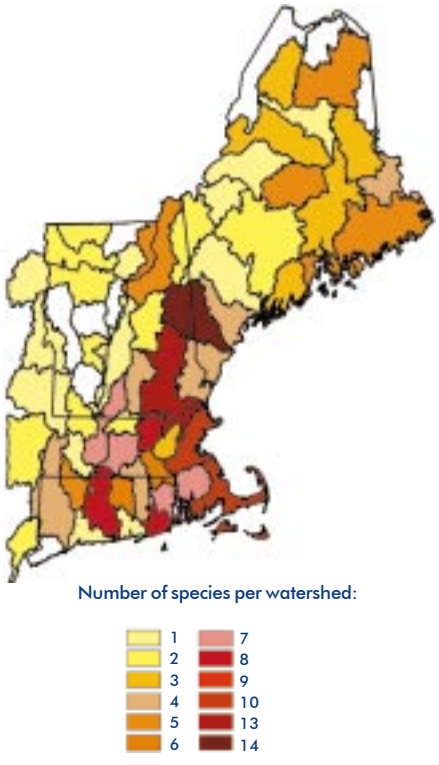
The Quinnipiac Watershed

The Quinnipiac River in south central Connecticut suffers from its historic contamination, heavy development, dense population, and the high demand for its water. The river continues to be degraded by stormwater runoff and excessive water withdrawals from the river and underlying groundwater. EPA-New England along with the Connecticut Department of Environmental Protection is working with the communities along the river to improve the condition of the watershed and reduce non-point source pollution in its river and tributaries. Activities include efforts to increase recreational access to the river, write model river ordinances, restore fish passage, and improve water quality.

National Estuary Program

During the past decade, EPA's National Estuary Program (NEP) has become a model for watershed/ecosystem-based environmental management. In New England, these projects have resulted in comprehensive conservation management plans involving local residents, agencies, and organizations in Massachusetts Bays, Buzzards Bay, Narragansett Bay, Casco Bay, Great Bay, and Long Island Sound. Working with local communities, participants in each of these major estuaries designed strategies to restore water quality and safeguard coastal ecosystems and embayments, maintain the region's historically strong shellfishery, and conduct monitoring studies to identify and eliminate sources of toxic and nutrient pollution.

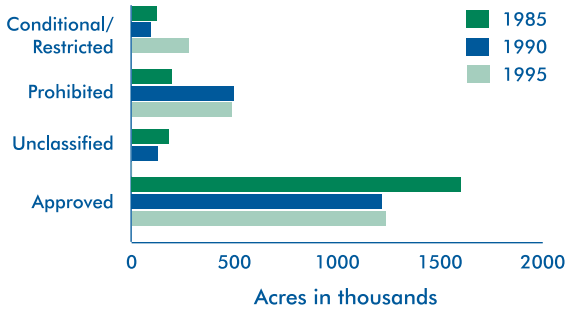
Figure 16
At-Risk Fish, Mussel, and other Freshwater Invertebrate Species



source: The Nature Conservancy and the International Network of Natural Heritage Programs and Conservation Data Centers

Areas with globally at-risk freshwater species require greater conservation attention to protect from the effects of sprawl and other environmental degradation.

Figure 17
Estuarine Shellfish Water Acreages in New England



source: National Oceanic and Atmospheric Administration, 1995

Photo: Ed Reiner

Partners in Flight

Birds are a central element of New England's biodiversity. They are vital to our economy through their control of agricultural pests, they provide enjoyment and recreation to millions of people, and they serve as critical indicators of environmental quality. While northern New England woodland species were generally increasing over the last decade, southern New England woodland species, especially ground and low nesting species have been declining. Factors include the increasing fragmentation and urbanization of our landscape and possibly increased predation by racoons, crows and domestic cats. Migratory bird populations are also declining as a result of habitat fragmentation in New England breeding grounds, deforestation in their Central and South American wintering grounds, and pesticide poisoning. In response to these trends, a coalition known as Partners in Flight (PIF), including EPA-New England, was established in 1990 to improve monitoring, research, management, and education programs about birds and their habitats.

The projects under the National Estuary Program have far-reaching, long-term benefits to local residents and watersheds. For example, the New Hampshire Estuaries Project's work has made it possible to reopen large portions of the Seabrook Middle Ground clam flat for recreational harvest for the first time in a decade. The Middle Ground flat is the most productive softshell clam flat in the state. The New Hampshire Estuaries Project has been directly involved in water testing, pollution source identification, and pollution reduction efforts in partnership with local and state agencies, towns, and a large number of individual volunteers. Significant improvements in water quality resulting from increased municipal sewerage coverage in the Town of Seabrook and other pollution control measures around Seabrook Harbor have made clamming on the flat possible once again.

Reconsidering the North Woods

Although essentially healthy, New England forests are under constant attack by a variety of pests, pathogens, and ecological and anthropogenic stresses. Forest health monitoring throughout the six states has shown that the region's forests are also experiencing damage from ground-level ozone pollution. Research has suggested that increases in temperatures and changes in precipitation regimes could harm forests growing in marginal conditions and those forests which could not endure more serious summer drought. Depending on the type of tree species and the specific growing conditions, some forests may continue to grow and function well, while others may decline in health or die. Spruce, which is important to New England's timber industry, is likely to decline in response to warming and drying.

Use of pesticides, especially herbicides, in forests has been a significant issue for several years in New Hampshire, Vermont, and Maine. Major concerns include pesticide drift from target application areas, impacts of the chemicals on public health and the environment, and clear-cutting and other forest management practices that use herbicides to suppress hardwoods and enhance conifer competitiveness. The New Hampshire Pesticide Control Board recently revised its rules to provide more notification and greater opportunities for public input. Vermont has initiated a moratorium on the application of herbicides as a forestry practice, which will remain in effect until 2003. Although the Maine Board of Pesticide Control rejected a petition to ban aerial application in 1995, the Board is sensitive to forest herbicide issues and has begun to implement improved notification and oversight measures. EPA is responsible for regulating pesticide use and funding the New England states to implement these pesticide regulations.

Liveable Communities

There is an old saying that some of the best things in life are free. Clean air cannot be bought in a store. Neither, we are realizing, can livable and sustainable communities. New England has a rich heritage of well-designed communities– our human-scale colonial villages and our urban neighborhoods like Boston's North End are seen as national models for patterns of living that are both environmentally sound and foster a sense of community among the residents. But as our population and economy continue to swell, many of these qualities are being compromised by haphazard, sprawling development. Poorly planned development has serious adverse impacts that affect the environmental integrity and quality of life of our communities. Open space disappears, waterways become polluted, roads become clogged even as people must drive farther and farther, with more driving threatening air quality gains. Worst of all, our sense of place and connection with our neighbors is eroded. Brownfields, properties abandoned because of real or perceived contamination, are left in the inner cities, while fields, farms, and forests continue to be lost.

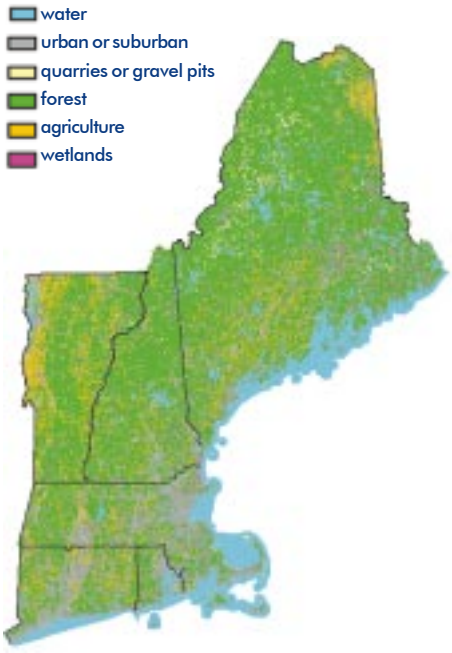
EPA-New England believes that it has a responsibility to help communities grow in a way that protects our most valuable natural resources. In the fall of 1998, EPA-New England developed its action plan for liveable communities and released it at an EPA-sponsored smart growth conference in February 1999.

Because land-use decisions are made on a local level, a major component of the Action Plan is building the capacity of local communities to better manage growth. We will be designing a Smart Growth training program, and bringing it to towns and municipalities throughout New England and training them in tools to manage growth. We will also be awarding $300,000 in liveable community grants to projects that combat sprawl, and will be working to see our state partners target their resources toward smarter growth initiatives. Finally, EPA-New England's Action Plan includes our federal partners in the Departments of Transportation and Housing and Urban Development. We have signed an agreement to build on the elements of President Clinton's Livability Initiative and target federal resources for smart growth in New England.

EPA-New England is committed to seeing all of our programs encourage better planning and growth. We will continue and expand our Urban Environmental Initiative and Brownfields programs to encourage development within cities rather than in undeveloped open space. We will be aggressively using our review authority for federally funded projects and wetlands impacts to oppose those projects that encourage sprawl. And we will be working to give states clean air credits for transportation policies that encourage compact development and reduce vehicle miles traveled.

Working together, we can ensure that the settlements we leave our grandchildren will be as livable, as environmentally sound, and as full of a sense of community as the ones our grandparents left us in New England.

Figure 18
New England Land Use



source: Multi-Resolution LAND Characteristics